FIG.1

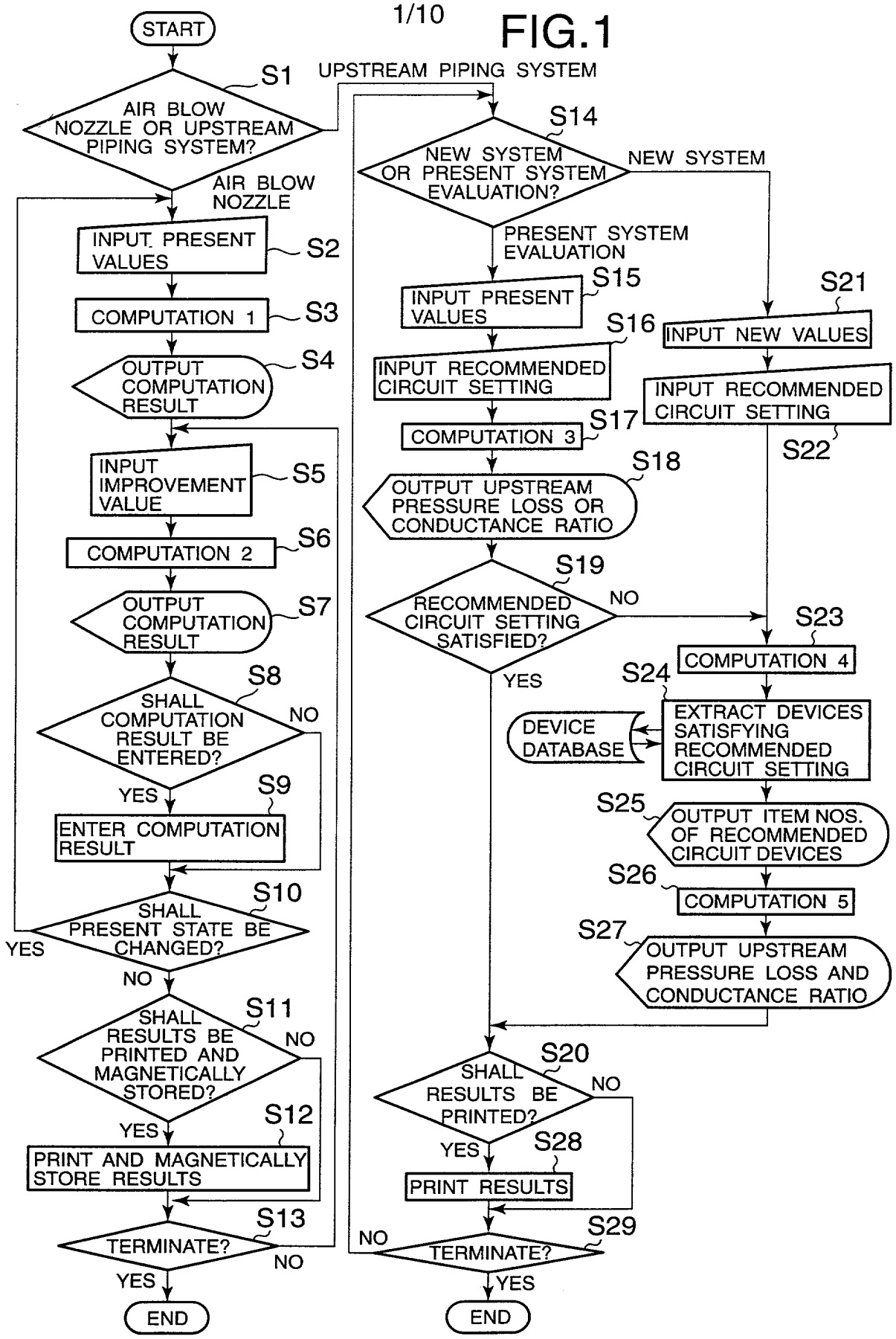

START
S1
AIR BLOW NOZZLE OR UPSTREAM PIPING SYSTEM?
AIR BLOW NOZZLE
UPSTREAM PIPING SYSTEM
INPUT PRESENT VALUES
S2
COMPUTATION 1
S3
OUTPUT COMPUTATION RESULT
S4
INPUT IMPROVEMENT VALUE
S5
COMPUTATION 2
S6
OUTPUT COMPUTATION RESULT
S7
S8
SHALL COMPUTATION RESULT BE ENTERED?
NO
YES
S9
ENTER COMPUTATION RESULT
S10
SHALL PRESENT STATE BE CHANGED?
YES
NO
S11
SHALL RESULTS BE PRINTED AND MAGNETICALLY STORED?
NO
YES
S12
PRINT AND MAGNETICALLY STORE RESULTS
S13
TERMINATE?
NO
YES
END
S14
NEW SYSTEM OR PRESENT SYSTEM EVALUATION?
NEW SYSTEM
PRESENT SYSTEM EVALUATION
S15
INPUT PRESENT VALUES
S16
INPUT RECOMMENDED CIRCUIT SETTING
S17
COMPUTATION 3
S18
OUTPUT UPSTREAM PRESSURE LOSS OR CONDUCTANCE RATIO
S19
RECOMMENDED CIRCUIT SETTING SATISFIED?
NO
YES
S20
SHALL RESULTS BE PRINTED?
NO
YES
S28
PRINT RESULTS
S29
TERMINATE?
NO
YES
END
S21
INPUT NEW VALUES
INPUT RECOMMENDED CIRCUIT SETTING
S22
S23
COMPUTATION 4
S24
DEVICE DATABASE
EXTRACT DEVICES SATISFYING RECOMMENDED CIRCUIT SETTING
S25
OUTPUT ITEM NOS. OF RECOMMENDED CIRCUIT DEVICES
S26
COMPUTATION 5
S27
OUTPUT UPSTREAM PRESSURE LOSS AND CONDUCTANCE RATIO

FIG.2

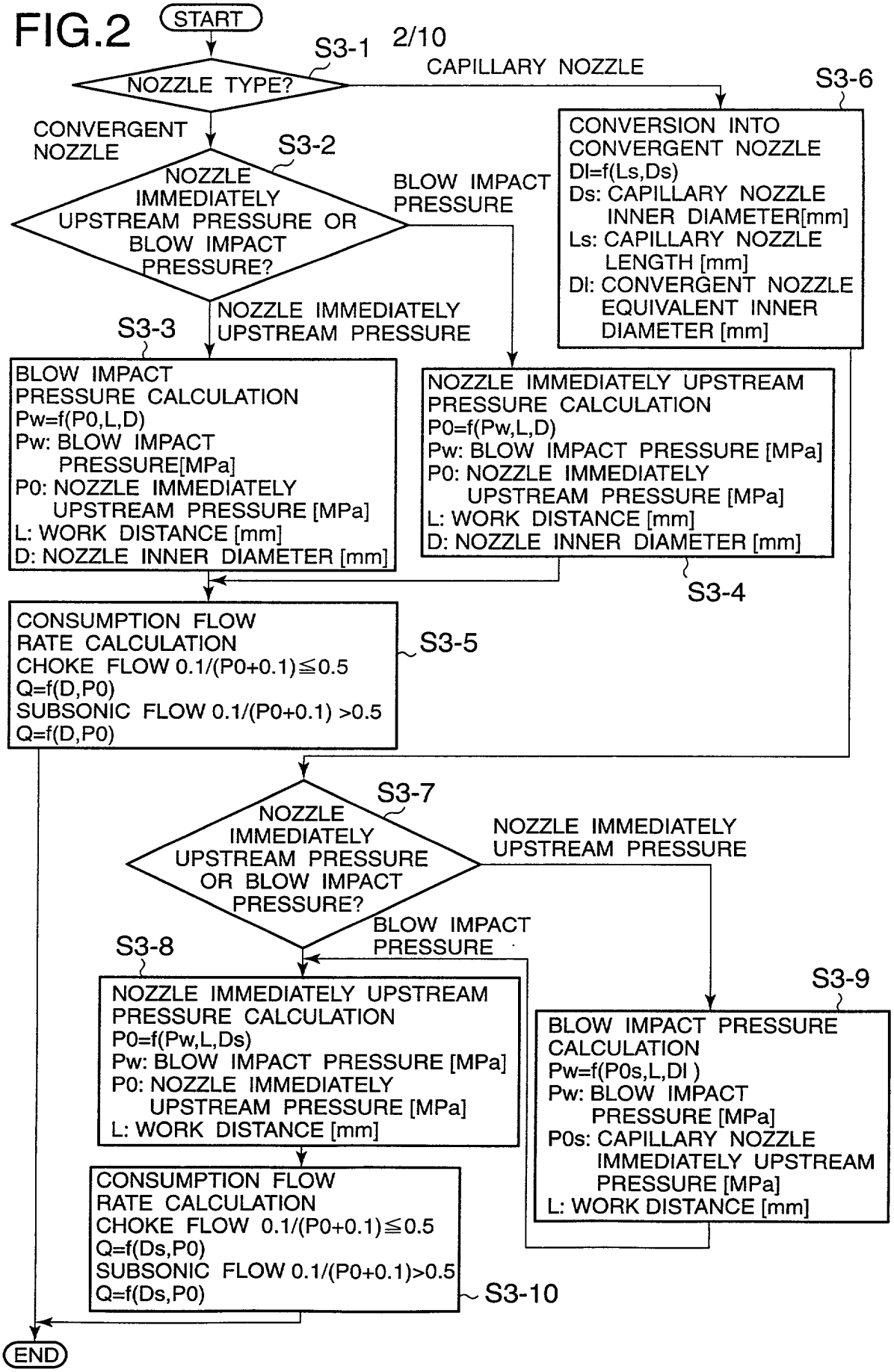

START
S3-1
2/10
NOZZLE TYPE?
CAPILLARY NOZZLE
S3-6
CONVERSION INTO CONVERGENT NOZZLE
DI=f(Ls,Ds)
Ds: CAPILLARY NOZZLE INNER DIAMETER[mm]
Ls: CAPILLARY NOZZLE LENGTH [mm]
DI: CONVERGENT NOZZLE EQUIVALENT INNER DIAMETER [mm]
CONVERGENT NOZZLE
S3-2
NOZZLE IMMEDIATELY UPSTREAM PRESSURE OR BLOW IMPACT PRESSURE?
BLOW IMPACT PRESSURE
NOZZLE IMMEDIATELY UPSTREAM PRESSURE
S3-3
BLOW IMPACT PRESSURE CALCULATION
Pw=f(P0,L,D)
Pw: BLOW IMPACT PRESSURE[MPa]
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
L: WORK DISTANCE [mm]
D: NOZZLE INNER DIAMETER [mm]
NOZZLE IMMEDIATELY UPSTREAM PRESSURE CALCULATION
P0=f(Pw,L,D)
Pw: BLOW IMPACT PRESSURE [MPa]
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
L: WORK DISTANCE [mm]
D: NOZZLE INNER DIAMETER [mm]
S3-4
CONSUMPTION FLOW RATE CALCULATION
CHOKE FLOW 0.1/(P0+0.1)≦0.5
Q=f(D,P0)
SUBSONIC FLOW 0.1/(P0+0.1) >0.5
Q=f(D,P0)
S3-5
S3-7
NOZZLE IMMEDIATELY UPSTREAM PRESSURE OR BLOW IMPACT PRESSURE?
NOZZLE IMMEDIATELY UPSTREAM PRESSURE
BLOW IMPACT PRESSURE
S3-8
NOZZLE IMMEDIATELY UPSTREAM PRESSURE CALCULATION
P0=f(Pw,L,Ds)
Pw: BLOW IMPACT PRESSURE [MPa]
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
L: WORK DISTANCE [mm]
S3-9
BLOW IMPACT PRESSURE CALCULATION
Pw=f(P0s,L,DI)
Pw: BLOW IMPACT PRESSURE [MPa]
P0s: CAPILLARY NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
L: WORK DISTANCE [mm]
CONSUMPTION FLOW RATE CALCULATION
CHOKE FLOW 0.1/(P0+0.1)≦0.5
Q=f(Ds,P0)
SUBSONIC FLOW 0.1/(P0+0.1)>0.5
Q=f(Ds,P0)
S3-10
END

FIG.3

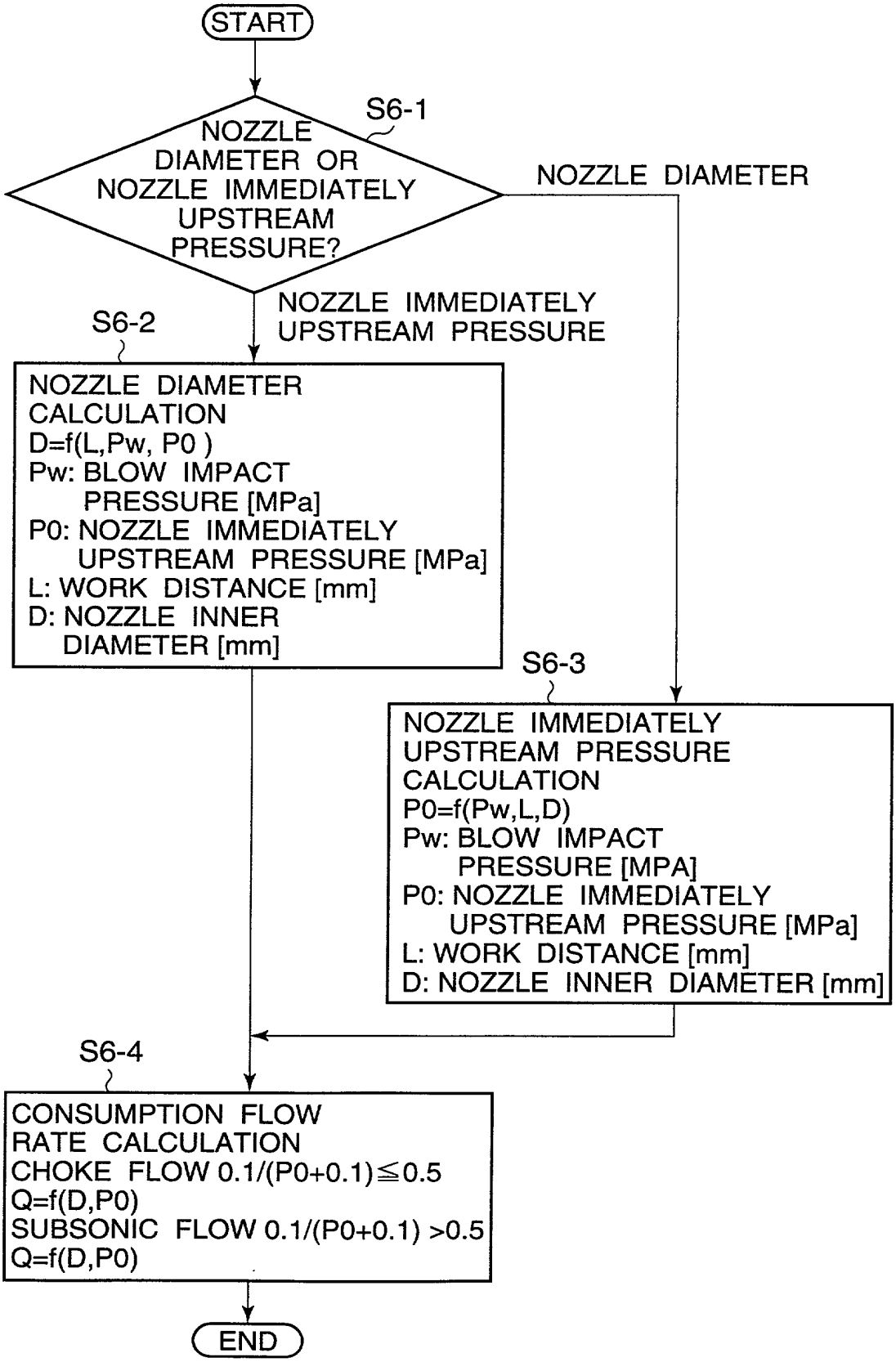

START
S6-1
NOZZLE DIAMETER OR NOZZLE IMMEDIATELY UPSTREAM PRESSURE?
NOZZLE DIAMETER
NOZZLE IMMEDIATELY UPSTREAM PRESSURE
S6-2
NOZZLE DIAMETER CALCULATION
D=f(L,Pw, P0)
Pw: BLOW IMPACT PRESSURE [MPa]
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
L: WORK DISTANCE [mm]
D: NOZZLE INNER DIAMETER [mm]
S6-3
NOZZLE IMMEDIATELY UPSTREAM PRESSURE CALCULATION
P0=f(Pw,L,D)
Pw: BLOW IMPACT PRESSURE [MPA]
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
L: WORK DISTANCE [mm]
D: NOZZLE INNER DIAMETER [mm]
S6-4
CONSUMPTION FLOW RATE CALCULATION
CHOKE FLOW 0.1/(P0+0.1)≦0.5
Q=f(D,P0)
SUBSONIC FLOW 0.1/(P0+0.1) >0.5
Q=f(D,P0)
END

FIG.4

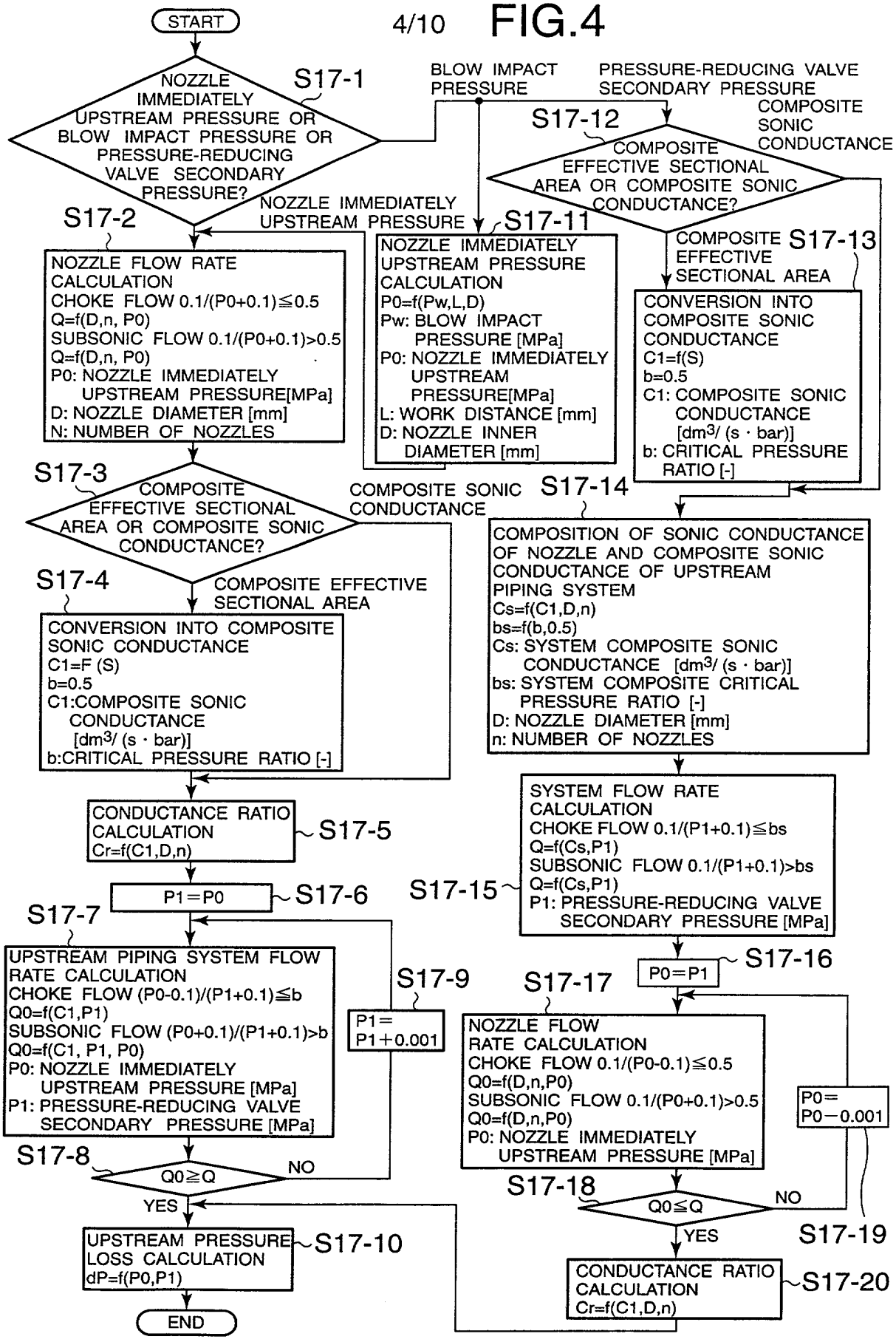

START
S17-1
NOZZLE IMMEDIATELY UPSTREAM PRESSURE OR BLOW IMPACT PRESSURE OR PRESSURE-REDUCING VALVE SECONDARY PRESSURE?
BLOW IMPACT PRESSURE
PRESSURE-REDUCING VALVE SECONDARY PRESSURE
S17-12
COMPOSITE EFFECTIVE SECTIONAL AREA OR COMPOSITE SONIC CONDUCTANCE?
COMPOSITE SONIC CONDUCTANCE
NOZZLE IMMEDIATELY UPSTREAM PRESSURE
S17-2
NOZZLE FLOW RATE CALCULATION
CHOKE FLOW 0.1/(P0+0.1)≦0.5
Q=f(D,n, P0)
SUBSONIC FLOW 0.1/(P0+0.1)>0.5
Q=f(D,n, P0)
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE[MPa]
D: NOZZLE DIAMETER [mm]
N: NUMBER OF NOZZLES
S17-11
NOZZLE IMMEDIATELY UPSTREAM PRESSURE CALCULATION
P0=f(Pw,L,D)
Pw: BLOW IMPACT PRESSURE [MPa]
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE[MPa]
L: WORK DISTANCE [mm]
D: NOZZLE INNER DIAMETER [mm]
COMPOSITE EFFECTIVE SECTIONAL AREA
S17-13
CONVERSION INTO COMPOSITE SONIC CONDUCTANCE
C1=f(S)
b=0.5
C1: COMPOSITE SONIC CONDUCTANCE [dm3/ (s · bar)]
b: CRITICAL PRESSURE RATIO [-]
S17-3
COMPOSITE EFFECTIVE SECTIONAL AREA OR COMPOSITE SONIC CONDUCTANCE?
COMPOSITE SONIC CONDUCTANCE
S17-14
COMPOSITION OF SONIC CONDUCTANCE OF NOZZLE AND COMPOSITE SONIC CONDUCTANCE OF UPSTREAM PIPING SYSTEM
Cs=f(C1,D,n)
bs=f(b,0.5)
Cs: SYSTEM COMPOSITE SONIC CONDUCTANCE [dm3/ (s · bar)]
bs: SYSTEM COMPOSITE CRITICAL PRESSURE RATIO [-]
D: NOZZLE DIAMETER [mm]
n: NUMBER OF NOZZLES
S17-4
COMPOSITE EFFECTIVE SECTIONAL AREA
CONVERSION INTO COMPOSITE SONIC CONDUCTANCE
C1=F (S)
b=0.5
C1:COMPOSITE SONIC CONDUCTANCE [dm3/ (s · bar)]
b:CRITICAL PRESSURE RATIO [-]
CONDUCTANCE RATIO CALCULATION
Cr=f(C1,D,n)
S17-5
P1=P0
S17-6
S17-15
SYSTEM FLOW RATE CALCULATION
CHOKE FLOW 0.1/(P1+0.1)≦bs
Q=f(Cs,P1)
SUBSONIC FLOW 0.1/(P1+0.1)>bs
Q=f(Cs,P1)
P1: PRESSURE-REDUCING VALVE SECONDARY PRESSURE [MPa]
P0=P1
S17-16
S17-7
UPSTREAM PIPING SYSTEM FLOW RATE CALCULATION
CHOKE FLOW (P0-0.1)/(P1+0.1)≦b
Q0=f(C1,P1)
SUBSONIC FLOW (P0+0.1)/(P1+0.1)>b
Q0=f(C1, P1, P0)
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
P1: PRESSURE-REDUCING VALVE SECONDARY PRESSURE [MPa]
S17-9
P1=P1+0.001
S17-17
NOZZLE FLOW RATE CALCULATION
CHOKE FLOW 0.1/(P0-0.1)≦0.5
Q0=f(D,n,P0)
SUBSONIC FLOW 0.1/(P0+0.1)>0.5
Q0=f(D,n,P0)
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
P0=P0−0.001
S17-8
Q0≧Q
NO
YES
S17-18
Q0≦Q
NO
YES
S17-19
UPSTREAM PRESSURE LOSS CALCULATION
dP=f(P0,P1)
S17-10
CONDUCTANCE RATIO CALCULATION
Cr=f(C1,D,n)
S17-20
END

FIG.5

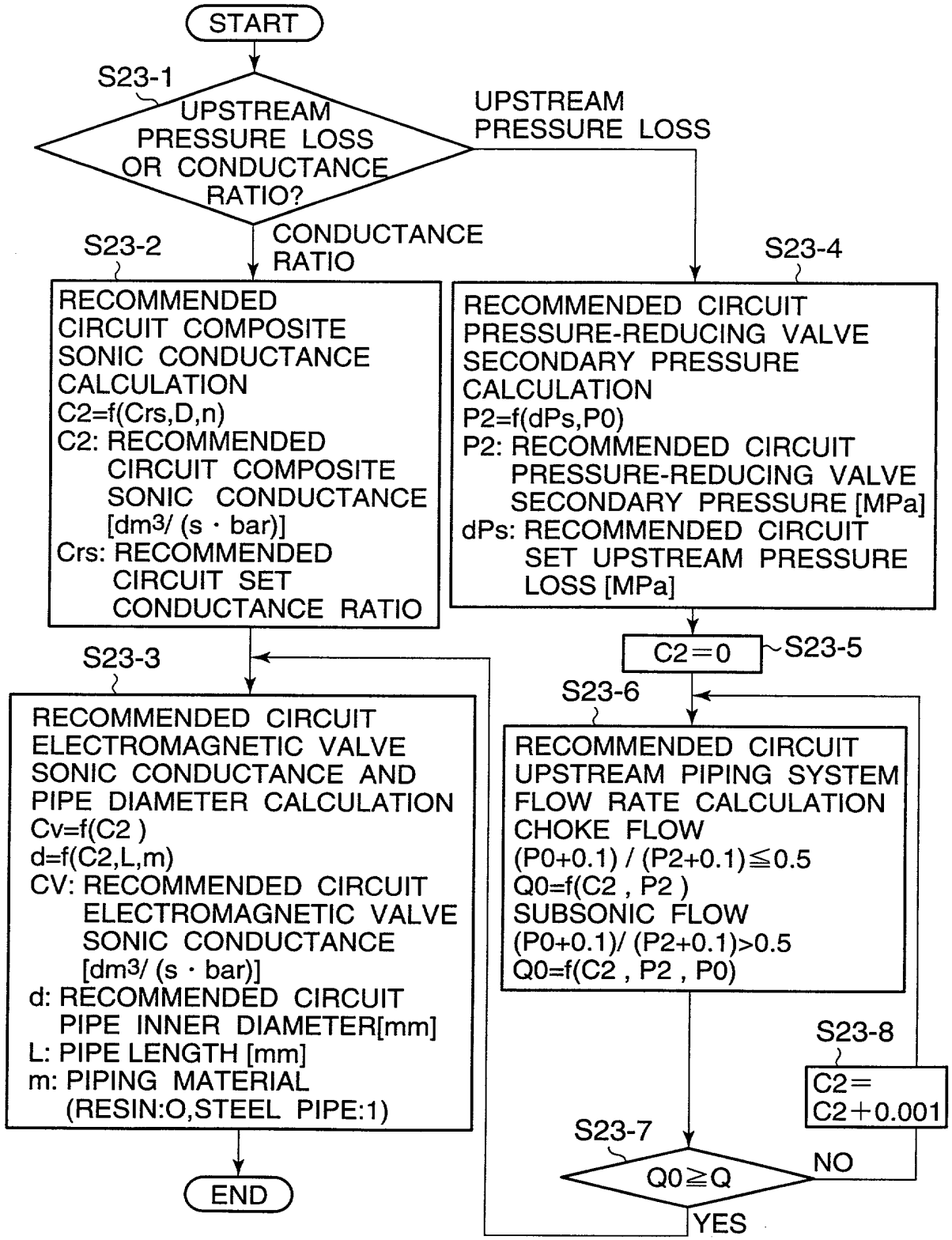

START
S23-1
UPSTREAM PRESSURE LOSS OR CONDUCTANCE RATIO?
UPSTREAM PRESSURE LOSS
CONDUCTANCE RATIO
S23-2
RECOMMENDED CIRCUIT COMPOSITE SONIC CONDUCTANCE CALCULATION
C2=f(Crs,D,n)
C2: RECOMMENDED CIRCUIT COMPOSITE SONIC CONDUCTANCE [dm3/ (s · bar)]
Crs: RECOMMENDED CIRCUIT SET CONDUCTANCE RATIO
S23-4
RECOMMENDED CIRCUIT PRESSURE-REDUCING VALVE SECONDARY PRESSURE CALCULATION
P2=f(dPs,P0)
P2: RECOMMENDED CIRCUIT PRESSURE-REDUCING VALVE SECONDARY PRESSURE [MPa]
dPs: RECOMMENDED CIRCUIT SET UPSTREAM PRESSURE LOSS [MPa]
C2=0
S23-5
S23-3
RECOMMENDED CIRCUIT ELECTROMAGNETIC VALVE SONIC CONDUCTANCE AND PIPE DIAMETER CALCULATION
Cv=f(C2)
d=f(C2,L,m)
CV: RECOMMENDED CIRCUIT ELECTROMAGNETIC VALVE SONIC CONDUCTANCE [dm3/ (s · bar)]
d: RECOMMENDED CIRCUIT PIPE INNER DIAMETER[mm]
L: PIPE LENGTH [mm]
m: PIPING MATERIAL (RESIN:O,STEEL PIPE:1)
END
S23-6
RECOMMENDED CIRCUIT UPSTREAM PIPING SYSTEM FLOW RATE CALCULATION
CHOKE FLOW
(P0+0.1) / (P2+0.1)≦0.5
Q0=f(C2 , P2)
SUBSONIC FLOW
(P0+0.1)/ (P2+0.1)>0.5
Q0=f(C2 , P2 , P0)
S23-8
C2= C2+0.001
S23-7
Q0≧Q
NO
YES

FIG.6

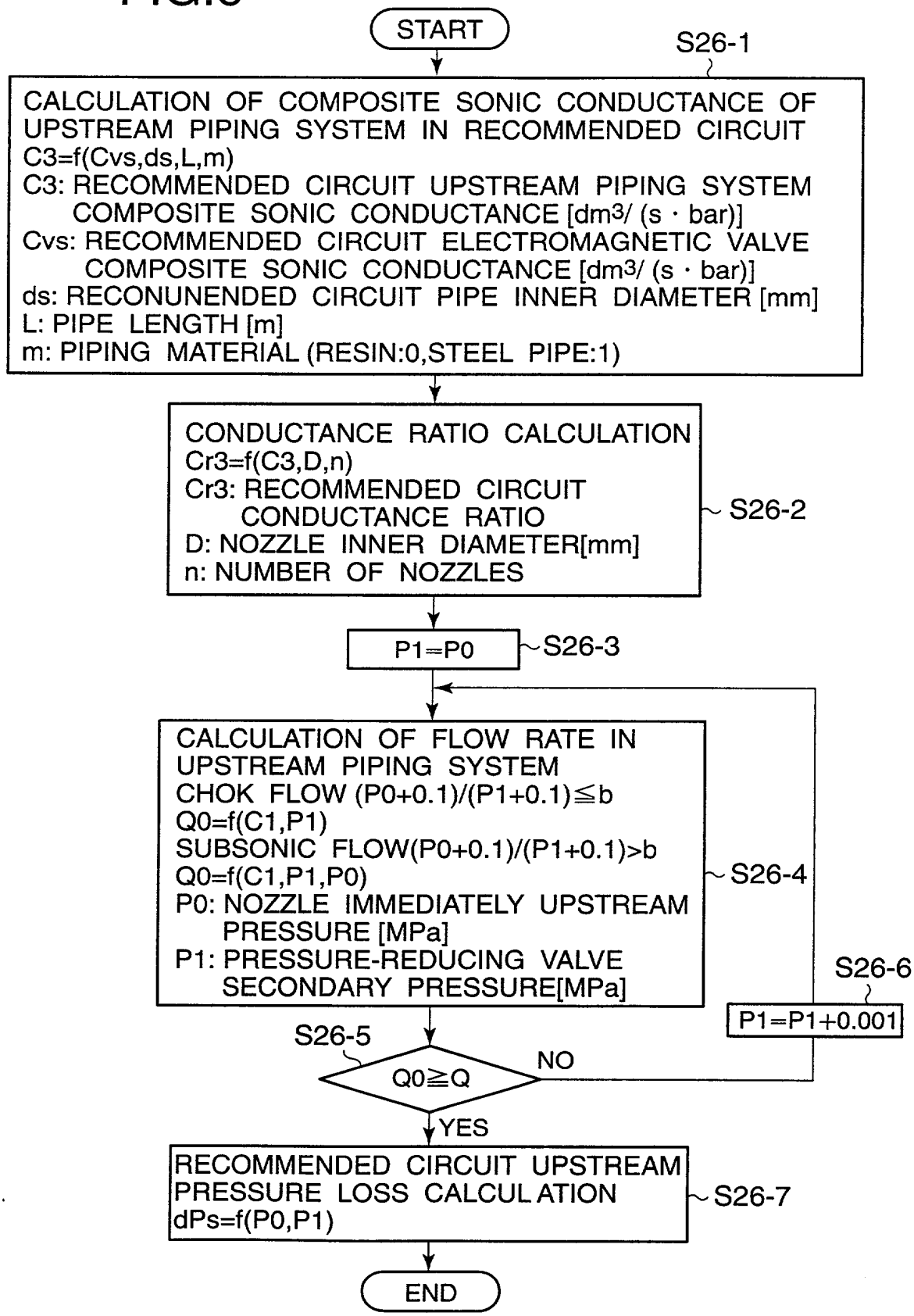

START
S26-1
CALCULATION OF COMPOSITE SONIC CONDUCTANCE OF UPSTREAM PIPING SYSTEM IN RECOMMENDED CIRCUIT
C3=f(Cvs,ds,L,m)
C3: RECOMMENDED CIRCUIT UPSTREAM PIPING SYSTEM COMPOSITE SONIC CONDUCTANCE [dm3/ (s · bar)]
Cvs: RECOMMENDED CIRCUIT ELECTROMAGNETIC VALVE COMPOSITE SONIC CONDUCTANCE [dm3/ (s · bar)]
ds: RECONUNENDED CIRCUIT PIPE INNER DIAMETER [mm]
L: PIPE LENGTH [m]
m: PIPING MATERIAL (RESIN:0,STEEL PIPE:1)
CONDUCTANCE RATIO CALCULATION
Cr3=f(C3,D,n)
Cr3: RECOMMENDED CIRCUIT CONDUCTANCE RATIO
D: NOZZLE INNER DIAMETER[mm]
n: NUMBER OF NOZZLES
S26-2
P1=P0
S26-3
CALCULATION OF FLOW RATE IN UPSTREAM PIPING SYSTEM
CHOK FLOW (P0+0.1)/(P1+0.1)≦b
Q0=f(C1,P1)
SUBSONIC FLOW(P0+0.1)/(P1+0.1)>b
Q0=f(C1,P1,P0)
P0: NOZZLE IMMEDIATELY UPSTREAM PRESSURE [MPa]
P1: PRESSURE-REDUCING VALVE SECONDARY PRESSURE[MPa]
S26-4
S26-6
P1=P1+0.001
S26-5
Q0≧Q
NO
YES
RECOMMENDED CIRCUIT UPSTREAM PRESSURE LOSS CALCULATION
dPs=f(P0,P1)
S26-7
END

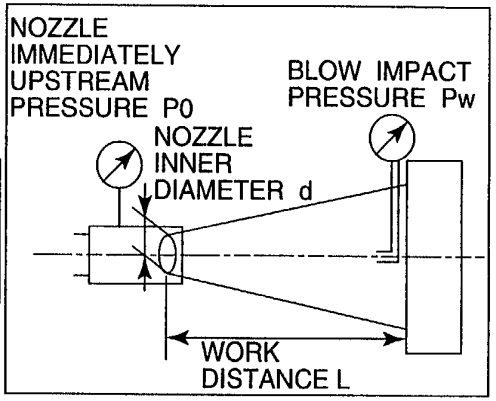
FIG.7

OPTIMIZATION OF AIR BLOW SYSTEM

OPTIMIZATION OF AIR BLOW NOZZLE | OPTIMIZATION OF UPSTREAM PIPING SYSTEM

IMPROVEMENT

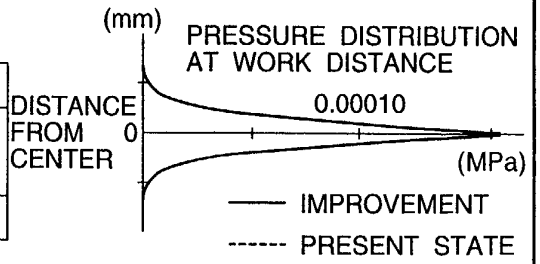
- ○ NOZZLE DIAMETER
- ◉ NOZZLE IMMEDIATELY UPSTREAM PRESSURE — 0.4 MPa
- WORK DISTANCE — 300 mm



	No	NOZZLE DIAMETER mm	NOZZLE IMMEDIATELY UPSTREAM PRESSURE MPa	BLOW IMPACT PRESSURE MPa	WORK DISTANCE mm	CONSUMPTION FLOW RATE $dm^3/min(ANR)$
IMPROVEMENT	2	0.86845	0.4	1.71E-04	300	31.987

CALCULATE | ENTER

	NOZZLE DIAMETER mm	NOZZLE IMMEDIATELY UPSTREAM PRESSURE MPa	BLOW IMPACT PRESSURE MPa	WORK DISTANCE mm	CONSUMPTION FLOW RATE $dm^3/min(ANR)$
PRESENT STATE	4	0.02	1.71E-04	300	121.39
IMPROVEMENT1	1	0.30597	1.71E-04	300	34.435
IMPROVEMENT2	0.86845	0.4	1.71E-04	300	31.987



PRESENT STATE CHANGE | DELETE | EDIT

SCREEN SHORTCUT | SAVE | CALCULATE | CALCULATOR | RETURN

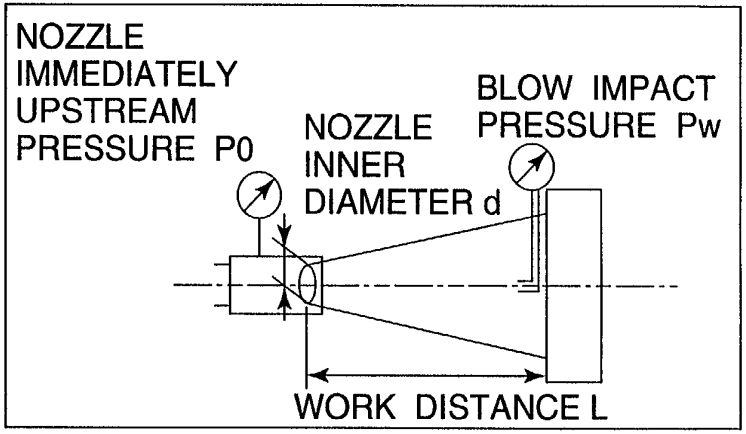
INTERNATIONAL SYSTEM OF UNITS | READ | PRINT | INPUT VALUE RESET | MENU

FIG.8

OPTIMIZATION OF AIR BLOW SYSTEM [PRESENT STATE INPUT]

PRESENT STATE

NOZZLE TYPE		CONVERGENT NOZZLE	
NOZZLE INNER DIAMETER(CONVERGENT)	d	4	mm
(•) NOZZLE IMMEDIATELY UPSTREAM PRESSURE	P0	0.02	MPa
( ) BLOW IMPACT PRESSURE	Pw		
WORK DISTANCE	L	300	mm



CALCULATOR | ✓ DECIDE | ✕ CANCEL

INTERNATIONAL SYSTEM OF UNITS

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FIG.9

OPTIMIZATION OF AIR BLOW SYSTEM

OPTIMIZATION OF AIR BLOW NOZZLE | OPTILNIZATION OF UPSTREAM PIPING SYSTEM

(•) PRESENT SYSTEM EVALUATION ( ) NEW SYSTEM

NOZZLE DIAMETER (CONVERGENT)	2 mm
NUMBER OF NOZZLES	10
(•) NOZZLE IMMEDIATELY UPSTREAM PRESSURE	0.2 MPa
( ) BLOW IMPACT PRESSURE	MPa
WORK DISTANCE	mm
( ) PRESSURE-REDUCING VALVE SECONDARY PRESSURE	MPa

UPSTREAM PIPING SYSTEM

(•) COMPOSITE SONIC CONDUCTANCE	5 $dm^3/(s \cdot bar)$
( ) COMPOSITE EFFECTIVE SECTIONAL AREA	mm^2

COMPOSITE VALUE INPUT

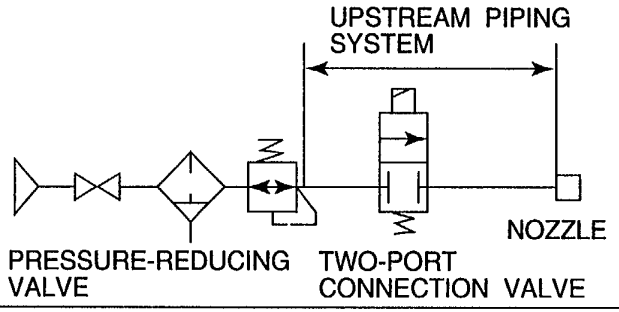
CRITICAL PRESSURE RATIO	0.5	(•) STEEL PIPE
PIPE LENGTH	10 m	( ) RESIN

RECOMMENDED CIRCUIT SETTING

(•) UPSTREAM PRESSURE LOSS	0.03 MPa OR LESS
( ) CONDUCTANCE RATIO	:1 OR MORE

<UPSTREAM: NOZZLE>

AIR BLOW SYSTEM RECOMMENDED CIRCUIT



DEVICE NAME	ITEM NOS.
PRESSURE-REDUCING VALVE	AR2000-[ ][ ]-[ ]
ELECTROMAGNETIC VALVE	VEX332[ ]-04[ ][ ][ ][ ]-[ ]
PIPE	SGP15A

	PRESENT STATE	RECOMMENDED CIRCUIT
UPSTREAM PRESSURE LOSS	0.096	0.025 MPa
CONDUCTANCE RATIO	0.8841:1	1.9396:1

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SCREEN SHORTCUT | CALCULATE | CALCULATOR | RETURN | PRINT | INPUT VALUE RESET | MENU

INTERNATIONAL SYSTEM OF UNITS

FIG.10

OPTIMIZATION OF AIR BLOW SYSTEM

OPTIMIZATION OF AIR BLOW NOZZLE | OPTILNIZATION OF UPSTREAM PIPING SYSTEM

○ PRESENT SYSTEM EVALUATION ◉ NEW SYSTEM

NOZZLE DIAMETER (CONVERGENT)	2 mm
NUMBER OF NOZZLES	5
○ NOZZLE IMMEDIATELY UPSTREAM PRESSURE	MPa
◉ BLOW IMPACT PRESSURE	0.001 MPa
WORK DISTANCE	300 mm
○ PRESSURE-REDUCING VALVE SECONDARY PRESSURE	MPa

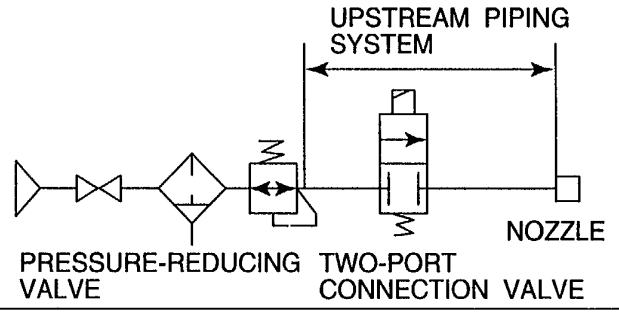
UPSTREAM PIPING SYSTEM

◉ COMPOSITE SONIC CONDUCTANCE	$dm^3/(s \cdot bar)$
○ COMPOSITE EFFECTIVE SECTIONAL AREA	mm^2 COMPOSITE VALUE INPUT
CRITICAL PRESSURE RATIO	○ STEEL PIPE
PIPE LENGTH 4 m	◉ RESIN

RECOMMENDED CIRCUIT SETTING

○ UPSTREAM PRESSURE LOSS	MPa OR LESS
◉ CONDUCTANCE RATIO	2:1 OR MORE <UPSTREAM: NOZZLE>

AIR BLOW SYSTEM RECOMMENDED CIRCUIT



DEVICE NAME	ITEM NOS.
PRESSURE-REDUCING VALVE	AR2000-[ ][ ]-[ ]
ELECTROMAGNETIC VALVE	VP542[ ][ ][ ][ ]-03A-[ ]
PIPE	T1613[ ]-[ ]

	PRESENT STATE	RECOMMLENDED CIRCUIT
UPSTREAM PRESSURE LOSS		0.022 MPa
CONDUCTANCE RATIO	:1	2.8779:1

SCREEN SHORTCUT | CALCULATE | CALCULATOR | RETURN | PRINT | F1 INPUT VALUE RESET | MENU

INTERNATIONAL SYSTEM OF UNITS